PHYSICS TEACHERS TRAINING NEEDS FOR IMPLEMENTATION OF SENIOR SECONDARY SCHOOL PHYSICS CURRICULUM: SUBJECT TEACHERS VIEWS

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Abstract

In this third millennium, it is crucial to ensure that the training of physics teachers is tailored to equip learners with the necessary skills and knowledge to excel in a global competitive environment. By tailoring their training, teachers can provide learners with a comprehensive understanding of physics concepts, enabling them to apply their knowledge effectively in real-world scenarios. This, in turn, will enable learners to excel in highly competitive academic and job markets worldwide. This study seeks evidence from physics teachers in both private and public schools on their training needs for effective implementation of the Senior Secondary School Physics Curriculum. One hundred and twenty (120) physics teachers from six (6) Area Councils in Federal Capital Territory (FCT)- Abuja were randomly sampled for the study. A structured questionnaire was used to collect data from the respondents. The instrument had a reliability of 0.75 using Cronbach Alpha technique. The study's findings suggest that training in various areas could benefit physics teachers in order for them to effectively engage their students and enhance the learning experience. These areas include active teaching strategies, technology integration, relevant assessment and evaluation techniques, and equipment improvisation for accuracy. Unfortunately, the current physics training programme may not adequately prepare teachers for these challenges, which could lead to physics not meeting high expectations due to a lack of necessary skills and knowledge on the part of physics educators. Recommendations were also advanced.

Keywords: Physics Education, Training Needs, Secondary Schools, Teachers

Introduction

Education is widely regarded as a valuable tool for promoting social service, fostering growth, and enhancing national consciousness and progress on a global scale. According to the World Bank, education is a key driver of economic growth and development, as it provides individuals with the skills and knowledge necessary to participate fully in society and the economy (World Bank, 2019). Additionally, a study by the Organisation for Economic Co-operation and Development (OECD) found that education is positively associated with civic engagement, social trust, and political participation (OECD, 2019). By equipping individuals with the necessary knowledge and skills, education can promote social service and help individuals become active and engaged citizens. In addition, education can foster growth by increasing productivity, innovation, and entrepreneurship, which can lead to economic development and progress (UNESCO, 2015). Effective teaching and learning in science education rely on a combination of factors that work together to enhance knowledge, skills, competence, and technology. It is through education that we can achieve these outcomes and ensure success.

According to Osokoya (2020), science education has become an essential factor in measuring human development. This statement is supported by various studies that have been conducted in different parts of the world. For instance, a study conducted by the UNESCO Institute for Statistics (UIS) shows that countries with high levels of scientific literacy tend to have higher levels of economic

development (UIS, 2018). Additionally, research conducted by the National Science Foundation (NSF) in the United States indicates that science education is critical for developing a skilled workforce that can drive innovation and economic growth (NSF, 2017)

The significance of science education lies in its ability to provide individuals with the necessary skills and knowledge to understand and tackle complex issues facing the world today. This education equips people with the tools to comprehend scientific research and data, enabling them to make informed decisions and contribute to global development. Moreover, science education promotes critical thinking, creativity, and problem-solving abilities that are vital for success in the modern world. It also cultivates a deeper understanding of the natural world and our place within it, fostering a sense of curiosity and wonder about the universe. Science education has become an integral part of human development, providing individuals with the tools and knowledge they need to succeed and contribute positively to society (Adewumi, 2021). The significance of science and technology in our world is increasing, and therefore, the necessity for science education is greater than ever. It is widely acknowledged that science education is valuable in Nigeria, which is why it is taught at all levels of education.

According to Nation Policy of Education (2014), secondary school education offers a diversified curriculum to cater to the differences in talents, opportunities, and future roles. Among the sciences, Physics as a subject is offered at the senior secondary school level and is considered a fundamental subject (Wenham, et al, 2021). It imbues learners with systematic thinking and supplies the theories necessary for understanding the mechanics of how things mankind relies on work. It provides students with analytical, problem-solving- solving and quantitative skills which is important for many sciences. Systematization of the scientific problem-solving techniques is employed. The link between physics and other sciences is profound. It continues to expand tremendously in the contemporary world. However, Physics education is a complex enterprise that requires a deep understanding of the subject matter and the ability to effectively communicate it to students. Effective teaching of physics requires a combination of knowledge, creativity, and instructional strategies to engage learners and help them understand the fundamental principles and applications of the subject. Due to the complexity of the discipline, ongoing training and retraining are necessary for physics educators to stay current and effective. The quality of education received by physics teachers is crucial since the academic competence of the teaching staff has a significant impact on the efficiency of the subject areas. As stated in the FRN (2014), no educational system can rise above the quality of its teachers.

By investing in teacher training, we can ensure that physics educators are equipped with the necessary knowledge and skills to deliver quality education. This will not only enhance the quality of science education but also promote the integration of technology in education at all levels. In recent times, there has been a stark contrast between the way teachers were educated in the past and the way they are educated today. In the past, many teachers were educated in classrooms where their primary role was to memorize information and conduct well-regulated experiments. They were then tested on their ability to repeat these tasks or remember specific facts. However, in today's technologically advanced world, almost every educational activity is achieved through the use of technology. To stay relevant in the ever-evolving educational landscape, teachers require continuous training and upskilling.

Teachers' training has been defined differently by various authors. According to the Oxford Advanced Learner's Dictionary (6th Edition), it is the process of enhancing teachers' competencies, pedagogical skills, and knowledge through continuous training to help them meet the challenges of modern-day classroom environments. The dictionary further emphasizes that no country can achieve socio-economic development without having a high-quality human capital. In the viewpoint Borti (2021), teachers' training needs are viewed as essential to the development of their capacity and are defined as a means of empowering teachers within the school system. The process of capacity building involves equipping teachers with the skills, knowledge, and abilities necessary to fully utilize their potentials towards achieving the educational goals. By focusing on capacity building, teachers can be empowered to reach their full potential and contribute effectively to the overall success of the school system. Antwi, Anderson & Abagali (2019) assert that teachers' intellectual capacity should be enhanced periodically through conferences, seminars, workshops, and other means to ensure organizational effectiveness. Asare, Mereku, Anamuah-Mensah & Oduro (2021) also highlight that teachers' in-service training is an indispensable tool for augmenting their knowledge, skills, attitudes, and competencies in achieving functional secondary education. Darling-Hammond, Hyler, & Gardner (2019) assert that an effective teacher can only be developed by quality professional preparation resulting from quality career development or professional development. Douglas, Agyei & Joke (2019), conducted a comprehensive study and discovered that continuous training of teachers enables them to acquire teaching skills and knowledge, share teaching experiences, collaborate with colleagues, and foster a supportive learning environment.

The Problem

The restructuring and reengineering of the senior secondary school physics curriculum, in response to national and global yearnings, have posed a significant challenge for educators and underscored the importance of their adequate preparation. However, despite the four-year training period they are exposed to, it is insufficient to cover the comprehensive subject matter and foundation courses in physics education, which has raised concerns about the competence of physics teachers. To address this challenge, there is a pressing need to implement training and retraining programs that bridge the gap in the initial training of secondary school physics teachers. According to Widen (2019), even the best pre-service teacher education cannot fully prepare one for a lifelong career as a teacher. Therefore, it is crucial to consistently allocate resources towards professional growth and development. In this context, this study aims to investigate the training needs of Physics teachers to enable them to effectively implement the SSS physics curriculum in the Federal Capital Territory (FCT) – Abuja.

Objectives of the Study

The objectives of this studies are to:

i. Identify physics teachers requisite training needs
ii. Ascertain the impact of present physics training programme on implementing the curriculum
iii. Find out perceived factors militating against the requisite training needs
iv. Suggest strategies for remedying the identified challenges

Research Questions

The study seeks to answer the following research questions:

i. What are the physics teachers' requisite training needs?
ii. To what extent do present physics training programme imparts on teachers' ability to implement SSS physics curriculum?
iii. What factors militate against acquisition of physics training needs?
iv. What are some effective strategies that can be employed to overcome these obstacles?

Hypotheses

The study is further guided by the following null hypotheses tested at a 0.05 level of significance.

H_{O1}: There is no significant difference in the scores of male and female senior secondary school physics teachers regarding training needs.

H_{O2}: There is no significant difference in the scores of male and female senior secondary school physics teachers on the impact of current training on teachers' abilities to implement the SSS physics curriculum.

H_{O3}: There is no significant difference in the scores of male and female senior secondary school physics teachers on factors militating against acquisition of physics training needs.

H_{O4}: There is no significant difference in the scores of male and female senior secondary school physics teachers on effective strategies to overcome training obstacles.

Method

The study employed a descriptive survey design. It was carried out in Federal Capital Territory (FCT) - Abuja with a target population of five hundred (500) physics teachers drawn from 16 senior secondary school (8 each from public and private schools); from which a sample of a hundred and twenty (120) respondents were selected using stratified purposive random sampling technique. The instrument used for data collection was a structured questionnaire developed by the researcher and titled 'Physics Teachers' Training Needs Questionnaire' (PTTNQ). The questionnaire consisted of two sections –A and B. Section A elicited information on respondents bio-data while section B sought information on respondents' views of training needs, impart of present physics training programme on their abilities to implement SSS physics curriculum, challenges that militate training and remedies to overcome the challenges. The validity of the instrument was ensured through expert opinions of two lecturers in science education from Faculty of education of the University of Abuja. Using Cronbach alpha, the reliability of the instrument was determined to be 0.75. Mean scores used to answer the research questions. Any questionnaire item with mean score greater than 2.50 was deemed as being favourably disposed to the respondents while below showed unfavourable disposition. The hypotheses were tested at a 0.05 level of significance using independent t-test statistical technique involving difference of means.

Results

Research Question One: What are the physics teachers' requisite training needs?

Table 1: Responses on Physics Teachers' Training Needs N = 120

S/N	Physics teachers' need training on:	VEH	HE	ME	LE	$\bar{X}$	SD	Remark
1	Use of active teaching strategies and techniques to enhance physics student engagement	57	39	18	6	3.23	0.83	Agreed
2	Integration of technology for physics lesson delivery	52	40	20	8	3.13	0.92	Agreed

3	Adoption of relevant assessment and evaluation strategies for physics related work	52	24	28	16	2.93	1.09	Agreed
4	Improvisation of physics laboratory equipment techniques for accuracy	28	28	44	20	2.53	1.02	Agreed
5	Use of research findings on various physics topics.	40	32	32	16	2.80	1.04	Agreed
6	Use of Teachers' Guide	32	32	40	16	2.67	1.01	Agreed
7	Enhancing Physics problem-solving skills in learners.	26	28	51	15	2.54	1.23	Agreed
8	Linking physics concepts to real life problems	34	25	28	23	2.54	0.82	Agreed
9	Preparing effective Physics lesson notes	29	30	44	20	2.64	1.04	Agreed
						2.78	0.59	

Table 1 displays the responses of teachers to various statements. The subscale consists of nine (9) items. The first statement, 'Use of active teaching strategies and techniques to enhance physics student engagement', received the highest mean score of 3.23, while the second statement, 'Integration of technology for physics lesson delivery', received the second highest mean score of 3.13. On the other hand, the lowest mean score of 2.53 was recorded for the fourth statement, 'Improvisation of physics laboratory equipment techniques for accuracy'. The grand mean score (2.78) is higher than the scale mean of 2.50, which indicates that teachers have needs further training.

Research Question Two: To what extent do present physics training programme impact teachers' abilities to implement SSS physics curriculum?

Table 2: Responses on Impart of Present Training Programme

S/N	Present training:	VEH	HE	ME	LE	$\bar{X}$	SD	Remark
1	Enables teachers to create student-centred teaching and learning experiences with ease	28	36	24	32	2.50	0.83	Agreed
2	Allows effective integration of technology for physics instructions	19	25	49	27	2.30	0.99	Disagreed
3	Imparts appropriate assessment knowledge to physics teachers	27	36	27	30	2.56	1.02	Agreed
4	Provides teachers with the opportunity to improvise laboratory equipment	12	4	32	72	1.62	0.95	Disagreed
5	Impact physics teachers with appropriate evaluation techniques	26	28	51	15	2.54	1.23	Disagreed
6	Provides information about physics curriculum structuring	24	28	32	36	2.33	1.01	Agreed
7	Provides knowledge regarding the use of teacher guides	18	4	39	59	1.05	1.11	Agreed
	Grand mean/SD					2.13	0.45	

Table 2 displays the responses of teachers to various statements in a subscale consisting of seven (7) items. Upon analysis of the responses, statement item 4 'Imparts appropriate assessment knowledge to physics teachers' received the highest mean score of 2.56, followed by the statement item 5 namely 'Impact physics teachers with appropriate evaluation techniques with a mean score of 2.54. On the other hand, statement item 8 namely: 'Provides knowledge regarding the use of teacher

guides' received the lowest mean score of 1.05. The grand mean score of the subscale is 2.13, which falls below the borderline of the scale mean of 2.50 It seems that the teachers felt that the current physics training program did not adequately prepare them to effectively teach the curriculum.

Research Question Three: What factors militate against acquisition of physics training needs?

Table 3: Responses of factors militating efforts in acquisition of training

		Teacher (120)						
S/N	To what extent do the following items militate against teacher training needs?	VEH	HE	ME	LE	$\bar{X}$	SD	Remark
1	Limited access to professional development opportunities	36	36	24	24	2.70	1.00	Agreed
2	Time constraints	24	56	32	8	2.80	0.83	Agreed
3	Lack of financial resources	36	44	28	16	2.93	1.01	Agreed
4	Isolation and feelings of isolation	32	36	16	38	2.53	1.18	Agreed
5	Resistance to change	38	36	24	22	2.75	0.98	Agreed
6	Balancing curriculum and professional development	32	32	40	16	2.67	1.01	Agreed
7	Limited opportunities for hands-on experience	36	20	58	6	2.72	0.95	Agreed
8	Balancing personal life and training	24	47	33	16	2.66	0.94	Agreed
						2.72	1.09	

Table 3 indicates that the statement regarding lack of resources received a mean score of 2.93, which is significantly higher than the scale mean of 2.50. This suggests that the majority of respondents agreed with this statement. Furthermore, the responding teachers also agreed with other item statements. The subscale score for challenges in acquiring training programs was 2.73, which is higher than the scale mean of 2.50. This indicates that the respondents face difficulties in their efforts to obtain training programs. Overall, the data suggests that lack of resources and other challenges in training are significant issues for the respondents.

Research Question Four: What strategies that can be employed for remedying the identified challenges?

Table 4: Responses of Strategies for Remedying Identified Challenges

S/N	Item statement	VEH	HE	ME	LE	$\bar{X}$	SD	Remark
1	School can collaborate with universities and professional organizations to provide workshops, conferences, and online courses specifically designed for physics teachers	37	35	25	23	2.71	0.98	Agreed
2	School can provide online training programs and webinars outside working hours.	24	56	32	8	2.80	0.83	Agreed
3	School partner with local businesses or community organizations to secure sponsorships or donations for professional development activities	37	39	28	16	2.81	1.01	Agreed
4	Teachers can establish networks of among themselves within and outside of their schools	39	37	15	29	2.71	1.18	Agreed

5	Teachers can engage colleagues through professional development activities, such as collaborative projects or peer coaching.	35	37	23	25	2.68	0.98	Agreed
6	School can allocate time during the school day for teachers to participate in professional development activities	32	32	40	16	2.67	1.01	Agreed
7	School can seek partnership with local research institutions, industries or educational institutions to provide opportunities for teachers to engage in hands-on experiments and activities	34	18	60	8	2.65	0.95	Agreed
8	Teachers can seek flexible training options, such as online or self-paced courses.	27	44	30	19	2.66	0.84	Agreed
	Grand mean/SD					2.71	0.58	

Table 4 presents the subscale consisting of eight (8) items. The highest mean score of 2.81 is attributed to item 3, which states that schools should partner with local businesses or community organizations to secure sponsorships or donations for professional development activities. Following closely is item 2, which suggests that schools can provide online training programs and webinars outside working hours, with a mean score of 2.80. On the other hand, item 7 received the lowest mean score of 2.65, which advocates for schools to seek partnerships with local research institutions, industries or educational institutions to provide opportunities for teachers to engage in hands-on experiments and activities. The grand subscale has an overall mean score of 2.71, indicating that the respondents are generally in favour of the items.

Hypotheses

H_{O1}: There is no significant difference in the scores of male and female senior secondary school physics teachers regarding training needs.

H_{O2}: There is no significant difference in the scores of male and female senior secondary school physics teachers on the impact of current training on teachers' abilities to implement the SSS physics curriculum.

H_{O3}: There is no significant difference in the scores of male and female senior secondary school physics teachers on factors militating against acquisition of physics training needs.

H_{O4}: There is no significant difference in the scores of male and female senior secondary school physics teachers on effective strategies to overcome training obstacles.

Table 5: t-Test of the Response of Male and Female Respondents of Subscales

S/N	Variable	Gender	Number N=120	Mean	SD	Df	t-cal	t-cri	Decision
H_{01}	Requisite training needs	Male	68	1.40	0.23		0.36	±1 .96	Accept H_{01}
		Female	52	1.38	0.39	118			
H_{02}	Impact of current physics training programme	Male	68	1.10	0.27		1.75	±1 .96	Accept H_{02}
		Female	52	1.03	0.13	118			
H_{03}	Challenges to acquisition training	Male	68	1.37	0.57		0.21	±1 .96	Accept H_{03}
		Female	52	1.35	0.48	118			
H_{04}	Remedies to identified challenges	Male	68	1.31	0.23		0.74	±1 .96	Accept H_{03}
		Female	52	1.40	0.47	118			

From table 5, the calculated t-values (t-cal) for all the null hypotheses with values ranging from 0.21 to 1.75 lies within the critical region of -1.96 to + 1.96. That is, the null hypotheses are not rejected. This means there is no significant difference between the responses of male and female physics teachers in respect to variables namely: requisite training needs, Impact of current physics training programme, challenges to acquisition training and Remedies to identified challenges.

Discussion of Findings

The study investigated physics teachers training needs for implementation of senior secondary school physics curriculum

The findings of the study on training needs revealed that respondents agree there is a need for training. The subscale grand mean for the training needs questionnaire was 2.78, indicating that participants strongly agree on the importance of training. Analysis of the cohort shows that 100 percent of the items have mean scores above 2.50. This indicates that all items were positively endorsed by the respondents, indicating a strong desire for training. For example, item 1, "Use of active teaching strategies and techniques to enhance physics student engagement," has a mean score of 3.23. This signifies that the majority of respondents expressed a strong desire to learn novel teaching techniques that will make their lesson delivery more engaging. This finding aligns with the study conducted by Mereku, Anamuah-Mensah & Oduro (2021), which found that 87 percent of teachers from Ghana are continuously exploring ways of improving their instructional delivery.

The results indicate the training program's inadequacy with an average score of 2.13. The findings on the impact of the current physics training program on the abilities of educators to effectively implement the curriculum are concerning.

The results of the impart of training program indicate its inadequacy with an average score of 2.13. This score indicates that the training program did not adequately meet the expectations and requirements of the participants. There is a clear need for improvement in this area to ensure that educators are equipped with the necessary skills and knowledge to deliver high-quality physics education to their students. This is in support of Adeyemi's (2021)) recent study, which highlights that the current physics teaching program falls short in adequately preparing teachers for effectively delivering the curriculum to meet the demands of their teaching. This inadequacy adversely affects the quality of teaching practices and ultimately hampers the students' understanding and retention of important physics concepts. Therefore, there is a need to address this inadequacy and enhance the existing teaching program to ensure better learning outcomes.

The study on the challenges that impede access to training reveals that the findings are not satisfactory, with a mean of 2.72. This supports Antwi Antwi, Anderson & Abagali,'s (2019). assertion that teachers lack the funds to attend conferences, which hinders their professional growth. Moreover, this study highlights that the teachers faced time constraints, which affected their ability to cover the physics syllabus on time. Physics teachers face a unique challenge in covering the curriculum effectively within a limited time frame. The subject's ever-evolving nature, together with the constant influx of new advancements, makes it difficult for educators to provide students with a comprehensive understanding of the subject matter. The limited time available poses significant challenges for both teachers and students, as they must navigate an extensive curriculum in a limited timeframe.

On measures to remedy the situation, findings from the study revealed that partnering with local businesses or community organizations to secure sponsorships or donations for professional development activities, providing online training programs and webinars outside working hours among others were positively disposed to as effective remedies

On strategies for remedying the identified challenges, the study found that one effective approach was to partner with local businesses or community organizations to secure sponsorships or donations for professional development activities. This was a welcome development among the respondents, as it allowed them to access valuable resources and training opportunities that they may not have been able to afford otherwise. Additionally, providing online training programs and webinars outside of working hours were also positively received as effective remedies. These measures can ensure that physics teachers have access to the necessary resources and support to further their skills and knowledge, ultimately benefiting the school and students as a whole.

Finally, on the test of hypotheses, there were no significant gender differences with respect to all the null hypotheses. This indicates that when it comes to training needs, male and female teachers have similar needs for delivery of the curriculum. This finding is significant because it challenges existing stereotypes and assumptions regarding gender differences in training needs. Traditionally, it has been believed that female teachers require different training compared to their male counterparts. However, the results of this study suggest that this is not the case. Both male and female teachers require similar training and support in order to effectively deliver the curriculum.

Conclusion

The study has revealed that physics teachers require training that encompasses a variety of skills and strategies to effectively engage their students. These include the use of active teaching techniques, integration of technology in lesson delivery, and implementation of relevant assessment and evaluation strategies in line with the SSS physics curriculum. The current training programs have not adequately prepared teachers for the challenges of 21st-century lesson delivery, they struggle to create engaging learning experiences for their students. Added to these, challenges such as time constraints and limited finances still hinder the effectiveness of physics teacher training. To address these issues, effective measures such as provision of online training programs and webinars outside working hours, as well as partnering with local businesses or community organizations to secure sponsorships or donations for professional development activities, should be implemented.

Recommendations

In light of the findings, the following recommendations are made:

i. School should collaborate with universities and professional organizations to provide workshops, conferences, and online courses specifically designed for physics teachers
ii. School should provide online training programs and webinars outside working hours.
iii. School can allocate time during the school day for teachers to participate in professional development activities
iv. School can seek partnership with local research institutions, industries or educational institutions to provide opportunities for teachers to engage in hands-on experiments and activities.
v. Teachers should seek flexible training options, such as online or self-paced courses.

References

Adeyemi S. O. (2021). Teaching and learning physics in Nigeria secondary school: The curriculumtransformation, issues, problems and prospects. *International Journal of Research and Technology* 2(1) 6

Adewumi, O. I. (2021). Staff training and development. In A. E. Achumba, & I. Asika (Eds). Reading in original

Antwi Antwi, V., Anderson I. K. & Abagali O. K. (2019). Effect of in-service training on scienceteachers' self- efficacy beliefs and content knowledge competencies in basic electronics in the Ghanaian Junior High School context. *European Journal of Engineering and Technology*, Vol. 4 No. 6, 1-14

Asare, E.O., Mereku D.K., Anamuah-Mensah & Oduro G.K.T (2021). In-service teacher education study in Sub-Saharan Africa. The case of Ghana.

Borti, A. (2021). Challenges in African classrooms: A case study of the Ghanaian context. *Research on Humanities and Social Sciences*, 5(4), 28-36.

Darling-Hammond L., Hyler M. E. & Gardner M. (2019). Effective teacher professional development. Palo Alto; Learning Policy Institute.

UNESCO Institute for Statistics. (2018). Study: Scientific literacy and economic development.

Widen, D.C. (2019). Relationship between training of teachers and effectiveness teaching. www.ijbssnet.com. *International Journal of Business and social Science,* 2(4), 11-19

World Bank. (2020). Education: A key driver of economic growth and development https://www.worldbank.org/en/topic/education